
Dischidia cleistantha (Apocynaceae, Asclepiadoideae): A New Philippine Endemic

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ABSTRACT. *Dischidia cleistantha*, a new species endemic to the Philippines, is described and illustrated. It is distinguished from three other species of *Dischidia* sect. *Conchophyllum* native to the Philippines by the character combination of corolla adaxially glabrous, 7–7.5 mm long, with corolline corona lobes opposite the corolla lobes, fleshy triangular dorsal staminal appendages, and unstalked staminal corona lobes.

Key words: Apocynaceae, Asclepiadaceae, Asclepiadoideae, *Conchophyllum*, *Dischidia*, Philippines.

Ongoing studies of the genus *Dischidia* R. Brown have revealed that a plant known in cultivation as *Dischidia* “Thailand Red” belongs to a new species endemic to the Philippines.

MATERIALS AND METHODS

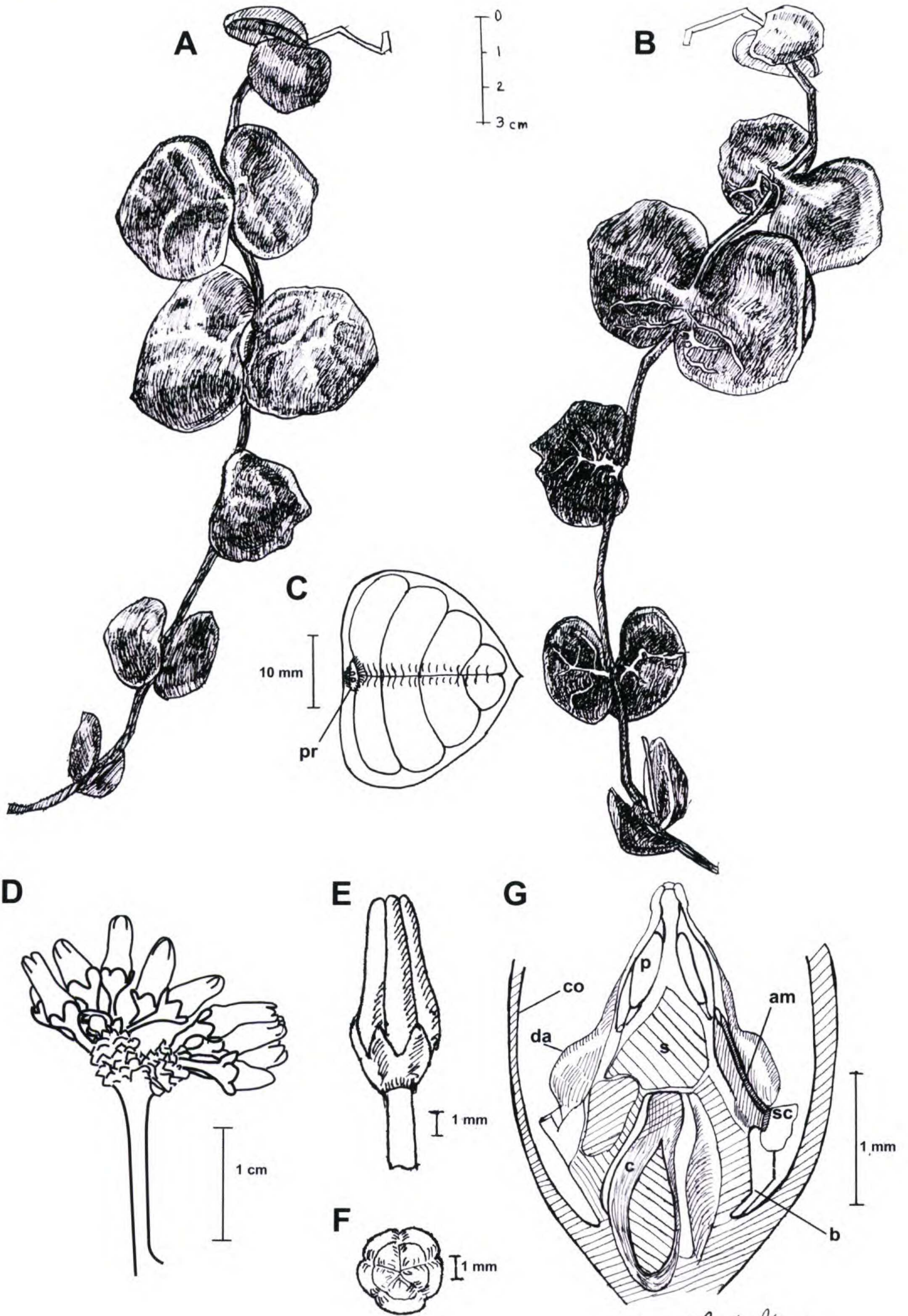
Specimens were observed with light and scanning electron microscopy (SEM). For SEM, flowers that had been preserved in FAA and stored in 70% EtOH were put through a dehydration series and critical-point dried; anther margins and pollinaria were removed from fresh flowers (vouchered by Livshultz 98-6, BH) and air-dried. All specimens observed with SEM were mounted on aluminum stubs with two-sided tape and dissected. Stubs were coated with gold-palladium and viewed with a Zeiss 960 SEM. All photography is digital. Figure 2C was retouched to remove a small nick in the corolla tube, 2D to remove a charge line, and Figure 2E to remove cracks in the background; retouching did not alter the morphology or micromorphology depicted in the images. Distribution of sclerenchyma in the stamens was determined by staining spirit-preserved flowers with phloroglucinol-HCl.

Dischidia cleistantha Livshultz, sp. nov. TYPE: Philippines. Zamboanga Province: Mindanao, Sep. 1922, *E. D. Merrill* 11639 (holotype, K; isotypes, P, US). Figures 1, 2, 3A, C–D.

Species foliis patelliformibus (convexo-concavis) in-

structa, a speciebus aliis omnibus distincta tubo corollae intus omnino glabro, lobis corollinis coronae lobis corollae oppositis, corona staminali ex lobis sessilibus ancoriformibus sub antheras insertis formata, appendicibus staminalibus dorsalibus ex lobis carnosis triangularibus constantibus.

Plants succulent, herbaceous epiphytic vines, root climbers and twiners, with white latex in all parts (Fig. 1A), glabrous except for sparse hairs near the margins of some younger leaves, lacking wax chimneys on stems and leaves (Fig. 3A). *Roots* on mature plants adventitious, always paired below each node, additional roots occasionally produced along internodes (Fig. 1B). *Stems* terete; diameter 1.5–3 mm; internodes 3.5–7.6 cm long. *Stipular colleters* a minute pair, triangular or ovate, to 0.5 mm long. *Leaves* always opposite, decussate at first, becoming distichous, peltate at maturity; petiole 1–3 × 1–2 mm; lamina with inflexed margins at first, at maturity the adaxial surface convex, green, the abaxial surface concave, purple (Fig. 1A, B), 1.3–3.6 × 1.6–5 cm, transverse-ovate to reniform, apex acute to obtuse, base truncate to slightly cordate, bearing a small protuberance with 1 to 3 colleters on the adaxial side (Fig. 1C); venation obscurely raised adaxially, invisible abaxially, brochidodromous, with 3–4 pairs of secondaries (Fig. 1C). *Inflorescence* (Fig. 1D) extra-axillary, umbelliform or compound-umbelliform, persistent; peduncles 0.4–2.0 × 0.15–0.2 cm, bearing 1–3(–4) stout rachises at their apices; rachises 3–4 mm diam., up to 1.4 cm long, with extremely short internodes, each rachis bearing 6 to 12 flowers and buds at its tip when actively growing; lower portions of rachises covered with transversely elliptical scars where flowers have fallen. Each *flower* subtended by two membranous triangular to lunate bracts ca. 0.5 × 0.5 mm; the bracts becoming chartaceous, persistent after flowers fall, but wearing off from the oldest parts of the rachises; *pedicels* 3–4 × 1 mm, pale green; *sepals* quincuncial, 1.5 × 1.5 mm, with a minute ovate colleter within each sinus, ovate, apex obtuse, pale green with hyaline margins, margins ciliate or not; *corolla* tube 7–7.5 × 3.5 mm, succulent, urceolate, 5-ribbed, the rounded, shallow



Michael Livshultz 01.

ribs separated by valleys opposite the corolla lobe sinuses (Fig. 1E, F); corolla lobes valvate, 2×1 mm, tips cucullate (Figs. 2A, 3C), connivent at anthesis, adaxial epidermal cells flattish tabular, ornamented with longitudinal striations (Fig. 2B) (terminology from Christensen & Hansen, 1998); *corolline corona* of 5 prominent lunate wedges inserted adaxially, 2.5 mm from the base of the corolla, opposite the lobes, inner surface of corolla tube rugose below the corolline corona (Fig. 2C); corolla at anthesis white suffused with purple, the pigment most prominent on the valleys and on the margins of the corolla lobes, pigment actually in the subepidermal cells of the adaxial corolla surface, on the margins and tips of the corolla lobes, the valleys between ridges (Fig. 3C), the corolline corona lobes and the tube below the corolline corona lobes, entire flower becoming pale pink with age. *Gynostegium* 2.5×2 mm, conic in outline, almost sessile, basal (filament) tube 0.2 mm long (Fig. 1G); *anthers* triangular, 2×1 mm; connectives dark purple with triangular, white, hyaline appendages covering the style-head apex; each anther margin with an inner and an outer edge (Fig. 2E); the outer edges form an open "mouth" at the base of the anther margins, revealing the inner edges (Fig. 2D); *staminal corona* of five unstalked lobes inserted at the bases of the anthers, each lobe with two recurved arms at its apex, white (Fig. 2D); *dorsal staminal appendages* of five fleshy, triangular lobes inserted on the abaxial surface of the anthers (Figs. 1G, 2D, 3C), each lobe suffused with pale purple pigment; *sclerenchyma* restricted to the anther margins, lateral margins of the dorsal staminal appendages, and the distal and outer edges of the arms of staminal corona lobes; *pollinarium* (Figs. 2F, 3D) with pollinia acropetal to the corpusculum when in situ, corpusculum narrowly elliptic, $230\text{--}240 \times 60\text{--}80 \mu\text{m}$, apex obtuse, rounded to truncate; caudicles flattened, with a thin region forming a channel along the outer edge (Fig. 2F), triangular with a long, narrow "thumb" extending from the apex of the outer edge, $300\text{--}330$ (including thumb) $\times 70\text{--}90 \mu\text{m}$; pollinium dorsiventrally flattened, narrow-obovate to elliptic, apex slightly truncate, $480\text{--}510 \times 100\text{--}110 \mu\text{m}$; *carpels* 1.2×0.4 mm diam., obclavate (Figs. 1G, 3C), *style-head* obtur-

binate, 5-angled in cross section with 5 reflexed lobes alternating with the stamens, 1.4×0.8 mm; apex acuminate, $0.8 \times \text{ca. } 0.2$ mm (Figs. 1G, 3C). *Fruit* a single follicle developing from each flower, pedicels $5\text{--}6 \times \text{ca. } 1$ mm, follicle $5.0\text{--}5.4 \times 0.3\text{--}0.5$ cm diam., reflexed relative to the pedicel, lanceolate in outline, widest 3.5 cm from the apex, gradually tapering toward both ends, apex obtuse, base rounded, cross section terete or half-terete (distorted by pressing), coriaceous and glabrous; *seeds* attached to a white, papery placenta, about 20 per fruit, 3×1 mm, ovoid, obscurely winged on the margin, testa smooth, glabrous; coma 2–2.5 cm long, white, silky.

Flowering specimens collected in January, February, August, September, November, and December from wild populations; continuously flowering under greenhouse conditions in Ithaca, New York.

Common names. The Tagalog name is reported as "pag-ong-pag-ongan" (Fox 9073). In cultivation, this species is called "*Dischidia* 'Thailand Red'" or "*D.* 'Thailand Blush'".

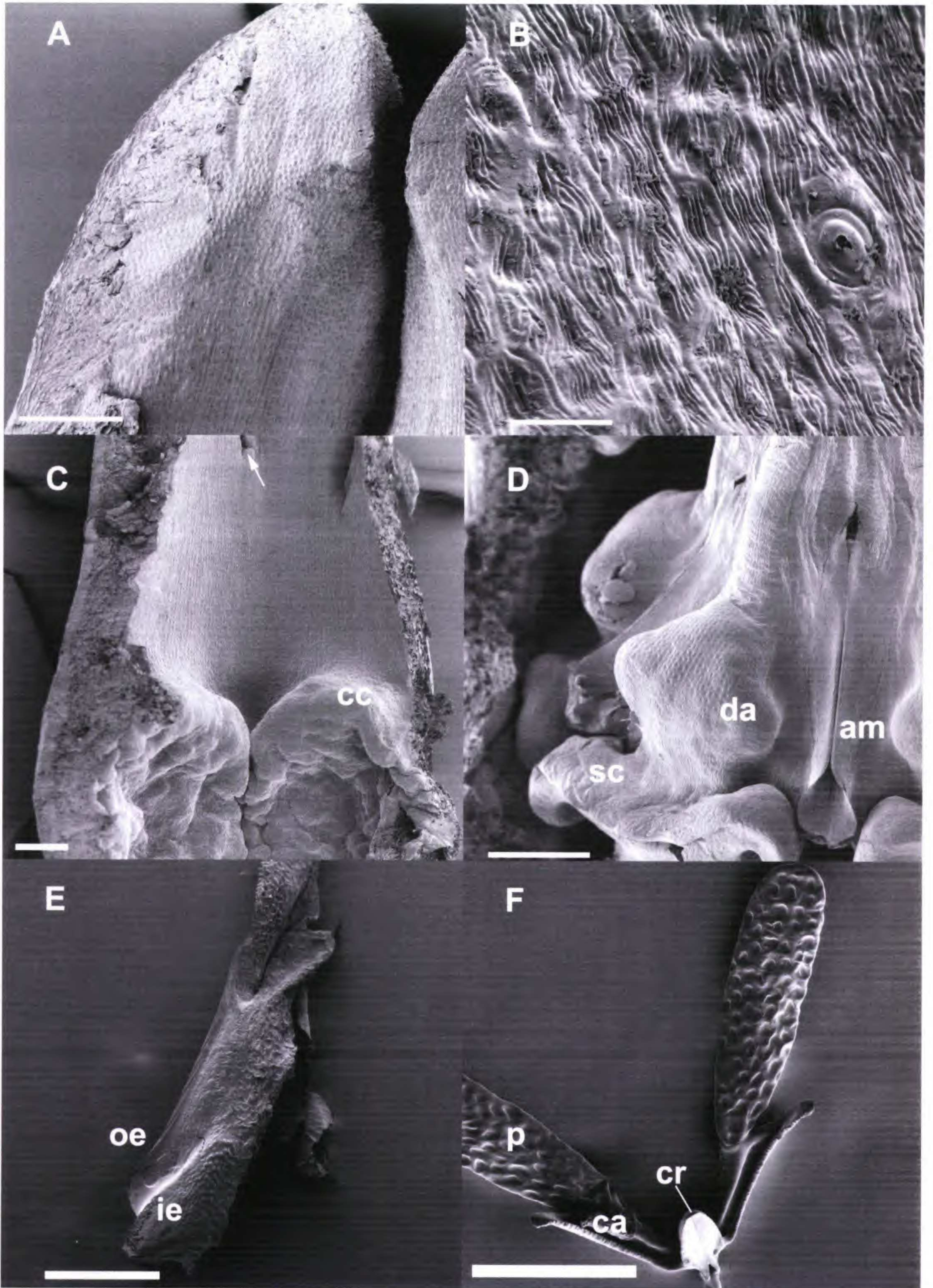
Etymology. The specific epithet is derived from the closed appearance at anthesis of flowers from living plants.

DISCUSSION

Dischidia cleistantha is one of several previously undescribed shell-leaved species from the Philippines. Specimens of *D. cleistantha* have been identified as *D. purpurea* Merrill, *D. platyphylla* Schlechter, and *D. imbricata* (Blume) Steudel on herbarium labels. Merrill 8319 was listed among the exsiccatae of *D. platyphylla* in the *Enumeration of Philippine Flowering Plants* (Merrill, 1923). The first two of these species are endemic to the Philippines (Merrill, 1923), whereas *D. imbricata* is widespread in Malesia (Rintz, 1980) but collected only from Palawan in the Philippines (Livshultz, pers. obs.). Table 1 lists characters that can be used to distinguish them. The glabrous flowers of *D. cleistantha* easily distinguish it from *D. platyphylla* and *D. imbricata*, which have dense hairs on the bases (*D. platyphylla*) or tips and margins (*D. imbricata*) of the adaxial side of the corolla lobes. *Dischidia cleistantha* has much larger flowers than *D.*

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Figure 1. *Dischidia cleistantha* Livshultz. —A. Branch, dorsal surface. —B. Branch, ventral surface. —C. Schematic drawing of adaxial leaf surface, showing protuberance with colleters and venation. *pr* = protuberance. —D. Inflorescence. —E. Longitudinal view of flower. —F. Apical view of flower. —G. Schematic drawing of longitudinal section of gynostegium in Figure 3C. Diagonal cross-hatching indicates cut surface. *co* = corolla; *da* = dorsal staminal appendage; *p* = pollinium; *s* = style-head; *am* = anther margin; *sc* = staminal corona; *c* = carpel; *b* = basal (filament) tube. Drawn from Livshultz 98–6.



purpurea (7 mm long vs. 2 mm long) and usually shorter peduncles (mostly less than 2 cm vs. mostly 7 cm or more).

Dischidia cleistantha and *D. purpurea* share several unusual characters that suggest a close phylogenetic relationship between the two species. Both species have 5-ribbed corollas with inflexed lobes at anthesis; the corolla lobes of *D. purpurea* separate slightly along their margins and the ribs are alternate with rather than opposite the corolla lobes. Both deposit purple pigment in the subepidermal layer of the adaxial side of the corolla while the abaxial cell layers remain unpigmented. Both have corolline corona lobes opposite the corolla lobes, although *D. purpurea* also has inconspicuous pouches in the sinuses of the corolla lobes. *Dischidia purpurea* has two distinct flower forms. One form has dorsal staminal appendages similar to those of *D. cleistantha* but no staminal corona. The other form has no dorsal staminal appendages but does have a staminal corona of unstalked lobes very similar to those of *D. cleistantha* except that the arms point up rather than down. It is still uncertain how these floral forms of *Dischidia purpurea* should be recognized taxonomically since they are otherwise identical. The unstalked staminal corona lobes of *D. cleistantha* and *D. purpurea* are unusual but evidently homologous to staminal corona lobes in other *Dischidia* species. The dorsal staminal appendages found in *D. cleistantha* and *D. purpurea* are much more restricted taxonomically, occurring also in *D. astephana* King & Gamble and *D. cochleata* Blume. It is convenient to communicate the homology of stamen ornaments among *Dischidia* species by distinguishing "dorsal staminal appendages" from "staminal coronas" even though "staminal corona" is the general term for any ornament of the stamens in Apocynaceae (Liede & Kunze, 1993).

Corolline corona lobes are typically alternate with the petals both in *Dischidia* and in the Apocynaceae as a whole (Liede & Kunze, 1993; Endress & Bruyns, 2000). In *Dischidia* species with annular corolline coronas, the annulus is enlarged opposite the corolla lobe sinuses, e.g., *D. astephana* King & Gamble (illustrated in Rintz, 1980). The

presence of lobes both opposite and alternate to the corolla lobes in *D. purpurea* suggests that the opposite and alternate lobes are not homologous.

Dischidia cleistantha has the typical shell-shaped leaves of *Dischidia* sect. *Conchophyllum* K. Schumann. Species in this section can easily be distinguished by using floral characters, but the minute dimensions of the flowers and their frequent absence from specimens can make species in this group difficult to identify. This may explain why *D. cleistantha* has remained undetected for so long both in herbaria and in cultivation. Vegetatively, *D. cleistantha* differs from most other species of the section in the absence of wax chimneys, donut-shaped white collars around the stomata (compare Fig. 3A to 3B) (see also SEM micrographs in Huxley, 1980; Theisen & Barthlott, 1994). In other species of section *Conchophyllum*, wax chimneys are most prominent on the abaxial surfaces of leaves, but they are present on both leaf surfaces as well as stems and peduncles. To the naked eye they appear as small white dots or a pruinose surface, depending on their density. The chimneys can be seen easily with a hand lens. Chimneys may be obliterated on older leaves by continued wax deposition; their occasional absence from herbarium specimens of species that typically have them is likely an artifact of preservation, either due to exfoliation of the epicuticular wax or coating of the specimen with glue. While leaves of herbarium specimens of *D. cleistantha* can look pruinose due to flaking off of the epicuticular wax, careful examination with a dissecting microscope shows that they lack chimneys. Presence or absence of wax chimneys is potentially a phylogenetically informative character in *Dischidia*. In section *Conchophyllum*, most species have wax chimneys except for *D. cleistantha* and some accessions of *D. purpurea* and *D. imbricata*. There is a cultivated accession of *D. imbricata* that lacks wax chimneys (vouchered by Livshultz 99-7, BH), so the polymorphism in this species is not due to artifacts of preservation. Wax chimneys are sporadic outside section *Conchophyllum*, occurring in *D. major* (Vahl) Merrill, *D. nummularia* R. Brown, *D. antennifera* Beccari, *D. bengalensis* Colebrooke, and *D. kutcinensis* Beccari.

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Figure 2. Floral morphology of *Dischidia cleistantha*.—A. Cucullate corolla lobes. —B. Adaxial surface of corolla lobe, flattish tabular epidermal cells with longitudinal striations. —C. Adaxial surface of corolla tube. *cc* = corolline corona lobe. The arrow points to a corolla lobe sinus. —D. Gynostegium. *sc* = staminal corona lobe; *da* = dorsal staminal appendage; *am* = anther margin. —E. Anther margin broken off and turned so that the inner edge is up. *ie* = inner edge; *oe* = outer edge. —F. Pollinarium. Corpusculum rotated relative to caudicles and greatly foreshortened. *cr* = corpusculum; *ca* = caudicle; *p* = pollinium. All scale bars = 200 μm except for B, scale bar = 20 μm . From Livshultz 98-6.

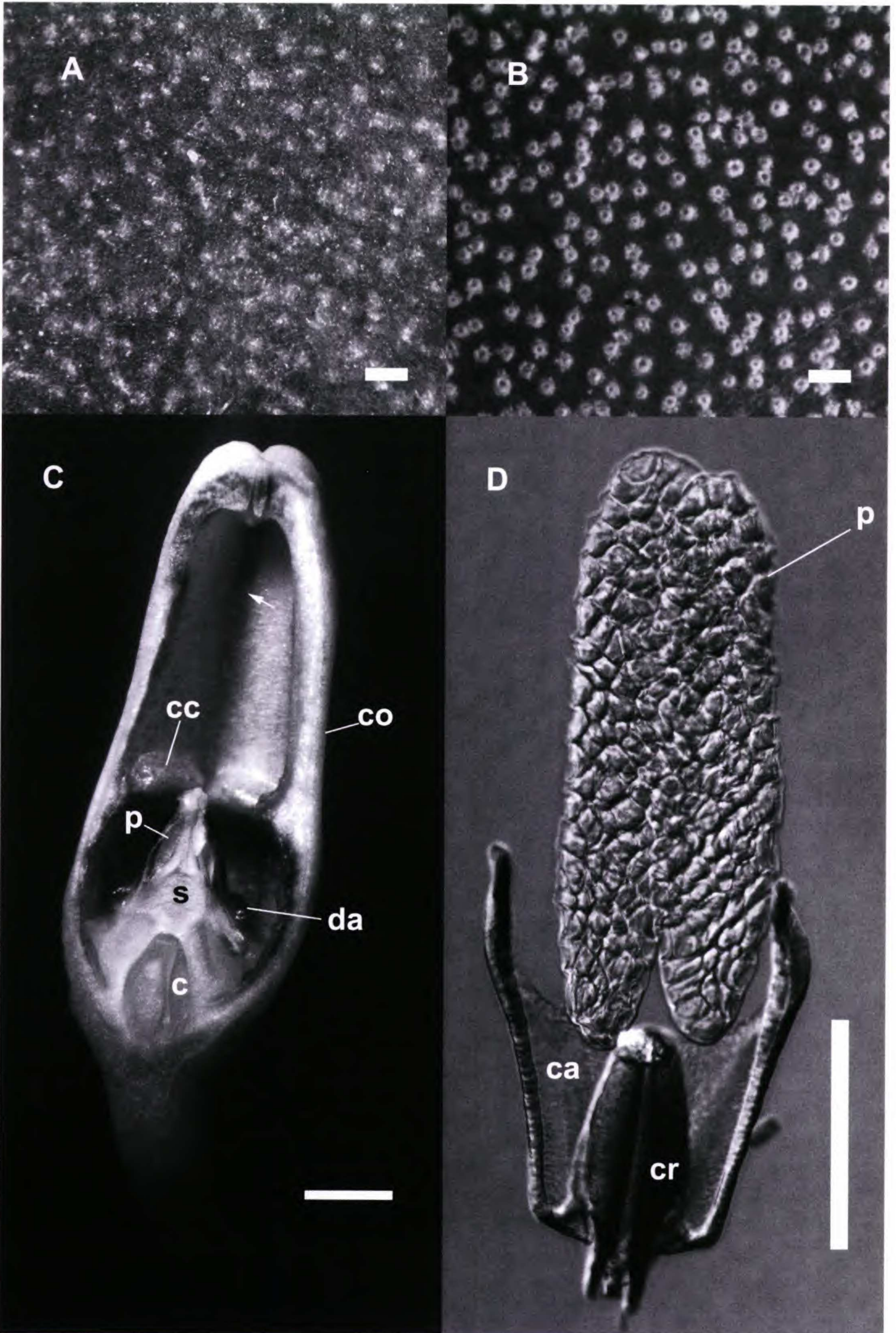


Table 1. Characteristics distinguishing *Dischidia cleistantha* from three other shell-leaved species native to the Philippines.

	<i>D. cleistantha</i> Livshultz	<i>D. purpurea</i> Merrill	<i>D. platyphylla</i> Schlechter	<i>D. imbricata</i> (Blume) Steudel
Wax chimneys	absent	present (absent)	present	present (absent)
Peduncle length (cm)	0.4–2.0	(0–6)7–22 usually at least one over 7 cm	1.5–6.0	1–5.5
Corolla tube length × width (mm) (fresh or reconstituted)	7–7.5 × 3.5	1.8–2.5 × 1.4–1.9	3–4 × 3–4.5	3–5 × 2.5–4.5
Corolla tube color	white suffused with purple, purple pigment localized on the adaxial surface, pink with age	pale purple, purple pigment localized on the adaxial surface, pink with age	pale yellow/cream, margins of corolla lobes pink	pale yellow/cream, corolla lobes sometimes tinged with pink
Hairs inside corolla tube	glabrous	glabrous or margins of corolla lobes sparse ciliate	dense tufts of long hairs at bases of corolla lobes	tips and margins of corolla lobes with long, dense retrorse hairs
Corolline corona	lobes opposite corolla lobes, inserted well below level of corolla lobe sinuses	minute pouches inserted in corolla lobe sinuses; vertical ridges opposite corolla lobes, extending from level of corolla lobe sinuses to base of corolla tube	lobes alternate with corolla lobes, inserted just below corolla lobe sinuses	lobes alternate with corolla lobes, inserted just below corolla lobe sinuses
Staminal corona lobes	present, unstalked, arms recurved, pointing down	present or absent; when present unstalked, arms pointing up*	present, stalked, held perpendicular or parallel to anther, arms recurved	much reduced, consisting of 2 small bumps below the anther, appearing to be absent
Dorsal staminal appendages	present, fleshy triangular lobe; in reconstituted specimens, appearing as two fleshy elliptic lobes inserted longitudinally	present or absent; when present a fleshy triangular lobe. In reconstituted specimens, appearing as two fleshy elliptic lobes inserted longitudinally*	absent	absent

* Individual specimens of *D. purpurea* have either a staminal corona or dorsal staminal appendages, never both. This character is consistent within specimens.

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Figure 3.—A. Abaxial leaf surface of *Dischidia cleistantha*; no wax chimneys. The small white bumps are stomata. —B. Abaxial leaf surface of *Dischidia platyphylla* Schlechter with wax chimneys. —C. Longitudinal section through flower of *Dischidia cleistantha* showing distribution of pigment in the corolla tube (*arrow*), the relative position of the corolline corona (*cc*) and the gynostegium, and a section through the gynoecium. Diagram of gynostegium shown in Figure 1G. *co* = corolla. The *arrow* points to pigment in the valley between two ridges; the valley is opposite the corolla lobe sinus. *cc* = corolline corona; *da* = dorsal staminal appendage; *s* = style-head; *c* = carpel. —D. Pollinarium of *Dischidia cleistantha*, in situ orientation. *p* = pollinium; *ca* = caudicle; *cr* = corpusculum. A, B, D scale bar = 200 μm, C scale bar = 1 mm. A, C, D from Livshultz 98–6; B from Livshultz 02–52 (BH).

Because of their succulence and complex floral structure, specimens of *D. cleistantha* are greatly distorted by pressing and drying. The papillae apparent along the leaf veins of herbarium specimens are an artifact of drying; there is no evidence of them on fresh leaves. They are not homologous to the papillae that blanket the epidermis in some other *Dischidia* species, e.g., *Dischidia hirsuta* (Blume) Decaisne. The corolla lobes of pressed flowers usually separate, and the ribs on the corolla tube are obscured. The corolline corona may appear as a continuous ring rather than distinct lobes. The "mouth" formed by the anther margins may be destroyed by separation of the margins. The staminal corona collapses when dried and may not be detectable without careful probing to separate the arms from the stamen. The central part of the dorsal staminal appendage collapses and the lobe appears as two longitudinal ridges. Fruits are described from an herbarium specimen, *Ramos & Edano 75232*; the orientation and shape of uncompressed fruits may differ.

Dischidia cleistantha is endemic to the Philippines. Its presence on the northern island of Luzon and the southern island of Jolo suggests a distribution throughout the archipelago. The available collection information indicates a lowland and coastal species. It has been collected from trees on the sea coast (*Fox 9073*), in a mangrove swamp (*Barbon et al. 2089*), and on a river bank (*Ramos & Edano 75232*).

Paratypes. PHILIPPINES. **Benguet:** Luzon, Kapungun, Tublay, *M. S. Clemens 17233* pro parte (NY). **Quezon:** Polillo, Karlangan, *R. B. Fox 9073* (A); Luzon, Burdeos, Botanan, *Barbon et al. 2089* (BRIT). **Catanduanes:** Catanduanes, St. Domingo River, *Ramos & Edano 75232*

(NY). **Zamboanga:** Mindanao, *H. Hallier 650* (NY); Mindanao, *H. Hallier 4650* (L); Mindanao, *E. D. Merrill 8319* (K, L, P, NY). **Basilan:** Basilan, Malamam, Mt. Basilan, *Moseley s.n.* (K). **Sulu:** Jolo, *Ramos & Edano 44404* pro parte (US, NY). CULTIVATED, PROVENANCE UNKNOWN. *T. Livshultz 98-6* (BH).

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